

A PRELIMINARY ACCOUNT OF THE EFFECT OF GRAZING UPON SPECIES OF *HELICHRYSUM* IN THE AMATOLE MOUNTAINS

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ABSTRACT

In the Amatole Mountains estimates of frequency, density and cover have been obtained to ascertain the reaction of certain species of *Helichrysum* to grazing. *H. argyrophyllum*, *H. odoratissimum* and *H. splendidum* are shown to be more abundant in the presence of grazing whilst *H. miconiaefolium* is depressed by grazing. *H. adenocarpum*, *H. ascendens* and *H. glomeratum* show little or no effects.

The relationship of firing, grazing and soil erosion and of the general disturbance of natural vegetation to the distribution of *H. argyrophyllum* DC. has been under investigation for many years. Story (1952) has summarised the work of Schonland (1923, 1927) and White (1948), and has given a detailed account of the autecology of this species on the Amatole Mountains. The upland sourveld of this region, however, is rich in other species of *Helichrysum*, which, although not so abundant, show interesting reactions to their environment.

The purpose of this paper is to describe observations made in 1957 in the Amatole Mountains upon the effect of grazing on certain species of *Helichrysum*. The study was made near the summit of Tor Doone, a promontory reaching 5,135 ft. on the edge of the escarpment joining the Hogsback Mountain to Gaikas Kop in the Keiskamma District of the Eastern Cape, some 14 miles north-west of Keiskammahoek. This area adjoins, and in topography and vegetation closely resembles, that which forms the subject of *A Botanical Survey of the Keiskammahoek* by R. Story (1952). The climate, soils and general features of the vegetation are described in detail by Story and need not be repeated here.

Tor Doone is crossed by a fence which delimits pasturage on the north-west side from sourveld and macchia on the south-east. The area studied consists of a gently sloping piece of open grassland of north-easterly aspect on the crest of the escarpment. As far as could be ascertained conditions were similar on the two sides of the fence, except for the presence of sheep grazing on the south-east side. The grazing pressure was not heavy and there was no soil erosion, although the grass was short.

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The frequency of *Helichrysum adenocarpum* DC., *H. adscendens* (Thb.) Less., *H. argyrophyllum* DC., *H. glomeratum* Klatt., *H. miconiaefolium* DC., *H. odoratissimum* (L.) Less., and *H. splendidum* Less. was estimated by the throwing of quarter square meter Raunkiaer rings. The samples were randomised as far as possible, a hundred throws being made over previously demarcated areas on each side of the fence. Unfortunately no precautions were taken to eliminate over-sampling of the centres of the plots (*vide* Greig-Smith 1952a) but this effect may have been diminished by the fact that ten samplers were working independently. The presence or absence of individuals of each species of *Helichrysum* was recorded for every throw. The results are shown in the accompanying table. Owing to the very different habits of the species they cannot be considered comparable biological units and a comparison between the species is hardly justified. The figures obtained must be regarded as indicative of certain interesting trends only. Using the method of contingency analysis (Greig-Smith 1957) the comparisons of the frequencies of *H. argyrophyllum*, *H. miconiaefolium*, *H. odoratissimum* and *H. splendidum* between the grazed and ungrazed areas are highly significant at the 0.05 level of probability. The frequencies of *H. adenocarpum*, *H. glomeratum* and *H. adscendens* within the two areas are not statistically significant, although in the case of the first two certain trends are indicated which might repay further investigation.

By reference to the table it can be seen that the frequency of *H. argyrophyllum* conforms to the general findings of Story *et al.*, being greater in the grazed than in the ungrazed area. *H. odoratissimum* and *H. splendidum* both show a similar increase of frequency in the presence of grazing. With regard to *H. miconiaefolium* the converse is true. The measure of frequency gives a misleading impression of the effect of this species, for in terms of cover it is considerable, owing to the formation of large clumps by a small number of plants in the grazed area. *H. adenocarpum*, a small, few-stemmed, non tussock-forming species, appears to be more frequent in the grazed area. In fact all over the Amatole Mountains it can be observed that this species does not tolerate competition with long grass or other tall plants. Like *H. argyrophyllum* it readily colonises the sides of cattle tracks and boulder-strewn places. *H. glomeratum* also shows a slight tendency to be more frequent in the grazed area but *H. adscendens* shows no reaction to grazing.

An estimate of density is also available for each of these seven species of *Helichrysum* on Tor Doone. They are represented by widely and irregularly scattered plants. In view of clumping and the very different habit of each species the average densities per unit area are liable to be misleading. Nevertheless in comparing the density of species within

Table showing the distribution of *Helichrysum* species on Tor Doonee, in terms of frequency, density and basal cover.

		Frequency		Density		Basal Cover	
		% fre- quency	χ^2 for mean differ- ence	% den- sity per $\frac{1}{4}$ sq. m.	t. for mean differ- ence	% cover per 1,000 points	t. for mean differ- ence
<i>H. adenocarpum</i> ..	Grazed ..	9	1.15	0.22	1.65	0.23	3.24"
	Ungrazed	5		0.06		0.02	
<i>H. adscendens</i> ..	Grazed ..	14	0.04	0.34	0.27	0.21	1.07
	Ungrazed	13		0.30		0.11	
<i>H. argyrophyllum</i> ..	Grazed ..	9	4.34'	0.30	2.14'	0.15	1.66
	Ungrazed	2		0.05		0.03	
<i>H. glomeratum</i> ..	Grazed ..	12	1.39	0.38	1.54	0.07	1.89
	Ungrazed	7		0.15		0.18	
<i>H. miconiaefolium</i> ..	Grazed ..	20	14.13"	0.45	2.57'	0.22	3.31"
	Ungrazed	45		1.04		0.46	
<i>H. odoratissimum</i> ..	Grazed ..	53	23.63"	1.55	3.96"	0.70	3.45"
	Ungrazed	19		0.39		0.28	
<i>H. splendidum</i> ..	Grazed ..	8	5.16'	0.11	6.00"	0.11	1.36
	Ungrazed	1		0.02		0.04	

Levels of significance indicated thus: ' = 0.05, " = 0.01, "" = 0.001.

the grazed and ungrazed areas it can be seen that the same general trends are followed as those of the estimates of frequency. *H. argyrophyllum*, *H. odoratissimum* and *H. splendidum* are denser in the grazed area whereas *H. miconiaefolium* is more dense in the ungrazed area. Using a modified t. test (Snedecor 1956, p. 97) the differences in densities of *H. adenocarpum*, *H. adscendens* and *H. glomeratum* in the two areas do not attain significance at the 0.05 level.

Basal cover was estimated by the point analysis method. Recordings were made of rooted plants at a thousand points in each area, the points being in two hundred randomly placed groups. From the table it can be seen that the measurements of basal cover also indicate that some species are depressed by grazing, others flourish and some are little affected. The significance of the differences of the means has been determined by an application of the t. test in which account is taken of the non-randomness of the groups of ten linked points (Greig-Smith 1957, p. 44). *H. adenocarpum* and *H. odoratissimum* both show a significantly greater cover in the grazed than in the ungrazed area, whereas the opposite is



Map showing the distribution of the clumps and large plants of *H. argyrophyllum* and *H. splendidum* near the summit of Tor Doonee.

the case with *H. miconiaefolium*. It is interesting to compare the figures for basal cover with the mapped distribution of *H. argyrophyllum* and *H. splendidum*. The map shows the occurrence of large plants or clumps of plants, small individuals not being recorded. On a basis of point analysis, basal cover below 0.05% is therefore not included and the picture is thus of the almost complete absence of *H. argyrophyllum* in the ungrazed area and the complete absence of *H. splendidum* in the grazed area. Even at this level of accuracy the ground cover of *H. argyrophyllum* is over 14% of the grazed and that of *H. splendidum* 7% of the ungrazed area. However the estimates of basal cover for these two species do not attain significance, demonstrating in a striking fashion the effect of mat formation. In the case of *H. argyrophyllum* there is a strong tendency for the patches to be associated with outcrops of rocks and a proportion of the ground covered is therefore bare rock overgrown by mats of *Helichrysum*. This rock is in the form of flattened domes, making a gentle angle with the soil surface. The rocks are therefore surrounded by a belt of very shallow soil which is easily dried out and also subject to considerable heating by the underlying rock. In situations of this kind *H. argyrophyllum* is at a competitive advantage.

Both *H. argyrophyllum* and *H. odoratissimum* are listed by Acocks (1953, p. 156) as "undesirable plants which should be reduced in number by appropriate veld management." Whereas it is true that both of these are indicative of degenerate pasture, and are of no nutritive value, they are not directly harmful, and in the case of *H. argyrophyllum* at least, do protect the soil from further damage (Schonland 1927).

ACKNOWLEDGMENTS

The author wishes to acknowledge the assistance of the students of the Department of Botany of Rhodes University who carried the equipment to the top of the mountain and who helped in the survey. Thanks are also due to Dr. A. R. Loveless for his helpful criticisms.

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